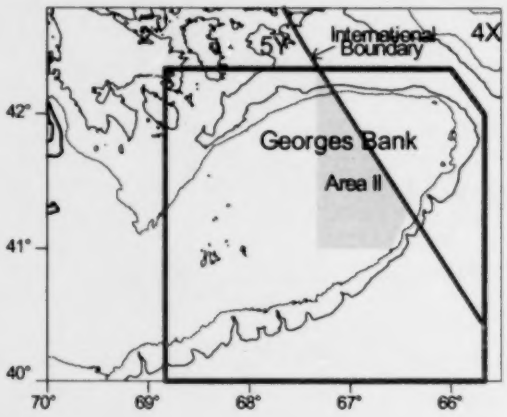
GEORGES BANK YELLOWTAIL FLOUNDER

[5Zhjmn; 522,525,551,552,561,562]



Summary

- Combined Canada and USA catches in 2006 were 2,206 mt.
- Adult biomass (ages 3+) increased from a low of 2,200 mt in 1995 to 11,400 mt in 2003 and then declined to 4,400 mt in 2005 and increased to 6,200 mt at the beginning of 2007. Spawning stock biomass in 2006 was estimated to be 5,000 mt.
- Recruitment improved from the mid-1990s averaging 23.6 million fish at age 1 during 1998-2001, but has since declined, with the exception of the 2006 value of 62.9 million, which is near the highest value in the time series.
- Fishing mortality for fully recruited ages 4+ was close to or above 1.0 between 1973 and 1994, fluctuated between 0.58 and 0.95 during 1996-2003, increased in 2004 to 1.88, and then declined to 0.89 in 2006.
- Truncated age structure in the surveys and changes in distribution indicate current resource productivity may be limited relative to historical levels.
- Assuming a 2007 catch equal to the 1,250 mt quota, a combined Canada/USA catch of about 3,500 mt in 2008 would result in a neutral risk (~50%) that the fishing mortality rate in 2008 will exceed F_{ref} (F=0.25). Fishing at F_{ref} in 2008 will generate a 16% increase in median age 3+ biomass from 21,400 mt in 2008 to 24,900 mt in 2009. These projections are highly dependent on the magnitude of the 2005 year-class.

Catches, Biomass (thousands mt); Recruits (millions)

		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Avg[1]	Min[1]	Max[1]
Canada	Quota	1.2	2.0	3.0	3.4	2.9	2.3	1.9	1.7	0.9	0.4			
	Landed	1.2	2.0	2.9	2.9	2.6	2.1	0.1	<0.1	<0.1		0.6	<0.1	2.9
	Discard	0.7	0.6	0.4	0.8	0.5	0.8	0.4	0.3	0.6		0.5	0.3	0.8
USA	Quota[5]							6.0	4.3	2.1	0.9			
	Landed	1.8	2.0	3.7	3.8	2.5	3.3	6.2	3.3	1.2		4.9	0.4	15.9
	Discard	0.1	0.5	0.4	0.3	0.2	0.4	0.5	0.5	0.4		0.6	<0.1	3.0
Total	Quota							7.9	6.0	3.0	1.3			
	Catch	3.8	5.0	7.4	7.9	5.9	6.6	7.3	4.1	2.2		6.7	1.2	17.2
Adult Biomass[3]		6.4	7.9	10.3	10.7	9.2	11.4	9.2	4.6	4.4	6.2	7.4[2]	2.0[2]	26.4[2]
SSB		7.0	9.5	10.5	9.5	10.5	10.5	6.0	4.4	5.0		7.6	2.6	21.9
Age 1 Recruits		23.9	25.5	21.0	23.8	16.2	12.2	12.5	14.9	62.9		23.6	6.6	70.6
Fishing mortality[4]		0.78	0.70	0.89	0.95	0.62	0.58	1.88	1.22	0.89		1.05	0.58	1.88
Exploitation Rate[4]		50%	46%	54%	56%	42%	40%	79%	65%	54%		58%	40%	79%

[1]1973 – 2006
[2]1973 - 2007
[3]Jan-1 ages 3+
[4]ages 4+
[5]for fishing year May 1 – April 30

Fishery

Combined Canada/USA catches of Georges Bank yellowtail flounder peaked at about 20,000 mt during the mid 1960s and early 1970s. The USA fishery accounted for most of the catches during the late 1960s and early 1970s. The combined Canada/USA catch increased from 1995 through 2001, averaged 6,600 mt during 2002-2004, but declined from 2005 (4,088 mt) to 2006 (2,206 mt; Figure 1).

The 2006 **Canadian catch** of 590 mt was well below the Canadian quota of 930 mt, with landings of only 25 mt and estimated discards of 565 mt. Canadian fishermen were unable to find commercial densities of yellowtail in 2006, similar to the situation in 2004 and 2005. Discards were due to the sea scallop dredge fishery.

USA catches in 2006 were 1,616 mt, a 58% decline from 2005, with landings of 1,239 mt and discards of 377 mt. The USA landings in 2006 were predominantly from the trawl fishery while discards came from both the trawl and scallop dredge fisheries.

Ages 2-4 accounted for most of the **combined Canada/USA fishery** catch in 2006 by number, with few age 1 fish caught due to mesh regulations. Both the Canadian and particularly the USA fisheries were well sampled to determine length composition of the catch.

Harvest Strategy and Reference Points

The Transboundary Management Guidance Committee has adopted a strategy to maintain a low to neutral risk of exceeding the fishing mortality limit reference, $F_{ref} = 0.25$. When stock conditions are poor, fishing mortality rates should be further reduced to promote rebuilding.

2008-04174/

State of Resource

The state of the resource was based on survey observations and the range of results from plausible age structured analytical assessments (VPA) that used fishery catch statistics and sampling for size and age composition of the catch for 1973 to 2006. The VPAs were calibrated to trends in abundance from three bottom trawl survey series (NMFS spring, NMFS fall and DFO) and a recruitment index from the NMFS scallop survey. Two VPA formulations were examined based on recommendations from the 2005 benchmark assessment review: 1) Base Case, the same formulation as used in the 2004 assessment, and 2) Major Change. Based on previous years' experience, the Minor Change VPA was not considered. Splitting the survey time series in 1995 is the only difference between the Base Case and the Major Change VPAs. The Major Change VPA shows unexpected large increases in survey catchability since the mid 1990s that are not understood.

The Base Case VPA and Major Change VPA were compared using retrospective patterns and agreement with survey biomass trends. Retrospective analyses were used to detect any patterns to consistently overestimate or underestimate fishing mortality, biomass, and recruitment relative to the terminal year estimates. The Base Case VPA continues to display a retrospective pattern, updating population biomass estimates to lower values than previously determined and compromising interpretation of results. The Major Change VPA did not exhibit a retrospective pattern; updates were both above and below previously estimated values (range 47% decrease to 59% increase). Trends in age 3+ biomass from the Base Case VPA do not follow the pattern of reduced abundance in the most recent years relative to the late 1990s and early 2000s as indicated by all three surveys (Figures 2-3) and this model is not recommended as the basis for management advice. The Major Change VPA better reflects the recent trend observed in all three surveys (Figures 2-3) and is recommended as the basis for management advice.

Population biomass (ages 3+), based on the Major Change VPA results, increased from a low of 2,200 mt in 1995 to 11,400 mt in 2003 and then declined to 4,400 mt in 2005 and increased to 6,200 mt at the beginning of 2007 (80% Confidence Interval: 5,000-8,000 mt) (Figure 3). Spawning stock biomass in 2006 was estimated to be 5,000 mt (80% Confidence Interval: 4,300-6,200 mt).

Recruitment improved from the mid-1990s averaging 23.6 million fish at age 1 during 1998-2001 but has since declined, with the exception of the 2005 year-class estimated at 62.9 million, which is near the highest value in the time series. Previous assessments indicated the presence of some large recruitment in the late 1990s and early 2000s, but the size of these cohorts is now estimated to be much lower. The 2005 year-class was observed at high levels in 2006 at age 1 in the NMFS Fall, NMFS Spring, and NMFS Scallop surveys, and observed at high levels in 2007 at age 2 in the DFO and NMFS Spring surveys. This coherence among surveys gives confidence that this year-class is well above average. However, the magnitude of this year-class will be better estimated as more observations become available.

Fishing mortality for fully recruited ages 4+ was close to or above 1.0 between 1973 and 1994, fluctuated between 0.58 and 0.95 during 1996-2003, increased in 2004 to 1.88, and then declined to 0.89 in 2006 (80% Confidence Interval: 0.67-1.13) (Figure 1). Fishing

mortality was well above the reference point of $F_{ref} = 0.25$ for the entire time series, in contrast to the perception of being below F_{ref} since 1995 as estimated in pre-2005 assessments.

Productivity

Age structure, spatial distribution, and fish growth reflect changes in the productive potential. In both absolute numbers and percent composition, the **population age structure** estimated by the VPA displays a truncated pattern with few old fish. As abundance continues to decline, **spatial distribution patterns** in the 2006 and 2007 surveys show yellowtail were caught in fewer strata relative to previous years. Truncated age structure in the surveys and changes in distribution indicate current resource productivity may be limited relative to historical levels.

Outlook

This outlook is provided in terms of consequences with respect to the harvest reference points for alternative catch quotas in 2008. Uncertainty about standing stock generates uncertainty in forecast results which is expressed here as the risk of exceeding $F_{ref} = 0.25$. It is considered that in this assessment these uncertainties, particularly those associated with the changes in survey catchabilities, are more problematic than in other assessments. As such, the standard risk plots do not capture the extent of uncertainty of the consequences for vario. catch levels. A sensitivity analysis illustrates the dependence of the projected 2008 catch on the magnitude of the 2005 year-class.

Due to fishery partial recruitment patterns over time and increasing trends in both survey and fishery weights at age, averages for 2004-2006 were used in the projections. Assuming that the TAC of 1,250 mt is caught in 2007, a combined Canada/USA catch of about 3,500 mt in 2008 would result in a neutral risk (~50%) that the fishing mortality rate in 2008 will exceed F_{ref}. Fishing at F_{ref} in 2008 will generate a 16% increase in median age 3+ biomass from 21,400 mt in 2008 to 24,900 mt in 2009.

The 2005 year-class accounts for 59% of the 2008 catch, 73% of the 2008 age 3+ biomass, and 60% of the 2009 age 3+ biomass. To demonstrate the sensitivity of these projections to the strength of the 2005 year-class, the projections were repeated with the 2007 age 2 value (the 2005 year-class) replaced by the average during 1997-2006 (14.8 million fish at age 2). Catching the 2007 TAC of 1,250 mt and fishing at F_{ref} in 2008 generates a combined Canada/USA catch of 2,000 mt (44% lower than the default projections). The age 3+ biomasses in 2008 and 2009 are 10,000 mt (53% lower than the default) and 13,900 mt (44% lower than the default), respectively. The 2005 year-class now only accounts for 30% of the 2008 catch, 44% of the 2008 age 3+ biomass and 31% of the 2009 age 3+ biomass. This sensitivity analysis is an extreme example because the average age 2 population abundance during 1997-2006 of 14.8 million fish, is well below the lower 80% confidence interval estimated from bootstrapping (34.6 million) and the point estimate (52.5 million) for the 2005 year class at age 2 in 2007. However, in the past, some year-classes that were estimated as strong were later found to be average when the cohort was observed for more years. If a 2008 TAC of 3,500 mt is caught, and the

2005 year-class is only average, the resulting fishing mortality rate would be about twice F_{ref}.

Special Considerations

Although the Major Change VPA is recommended for management decisions, the mechanism for the large changes in survey catchability are not easily explained. These changes in survey catchability are most appropriately thought of as an aliasing of an unknown mechanism that produces a better fitting model. The inability to plausibly explain these survey catchability changes causes increased uncertainty in this assessment relative to other assessments. However, the Major Change VPA results more closely reflect the recent trend in abundance observed in all three surveys and is the preferred model from which to make management decisions.

The realized fishing mortality rates have been higher than the target F used to set the quotas. In 2005, a catch of 2,100 mt in 2006 was projected to produce a fishing mortality of 0.25. However, the observed catch of 2,200 mt resulted in an F of 0.89. In contrast, when set in 2006, the 2007 TAC of 1,250 mt was expected to result in an F of 0.25. The F in 2007 is now projected to be 0.20 due to the well above average 2005 year-class. This highlights the difficulties of assessing this resource because of a strong retrospective pattern of unknown source, truncated age structure, and reliance on incoming year-classes. The current model, while an improvement over the Base Case model, should be used with these uncertainties in mind.

Source Documents

Legault CM, Stone HH, Waters C. 2007. Stock assessment of Georges Bank yellowtail flounder for 2007. TRAC Reference Document 2007/(in prep.).

TRAC. 2005. Gavaris S, O'Boyle R, Overholtz W, editors. Proceedings of the Transboundary Resources Assessment Committee (TRAC): Benchmark review of stock assessment models for the Georges Bank yellowtail flounder stock; 25 – 26 January 2005 and 26 – 29 April 2005. TRAC Proceedings 2005/01: 65p.

TRAC. 2007. O'Boyle R, O'Brien L, editors. Proceedings of the Transboundary Resource Assessment Committee (TRAC); 12–15 June 2007. TRAC Proceedings 2007/(in prep.).

Correct Citation

TRAC. 2007. Georges Bank Yellowtail Flounder. TRAC Status Report 2007/03.

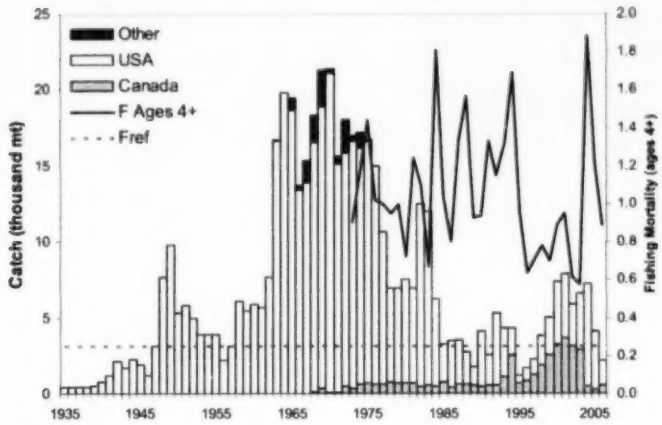


Figure 1. Catches and fishing mortality.

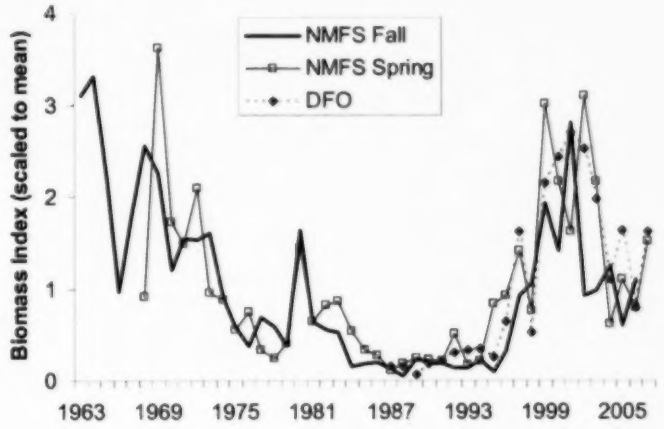


Figure 2. Survey weight (kg/tow) scaled to mean of 1987-2005.

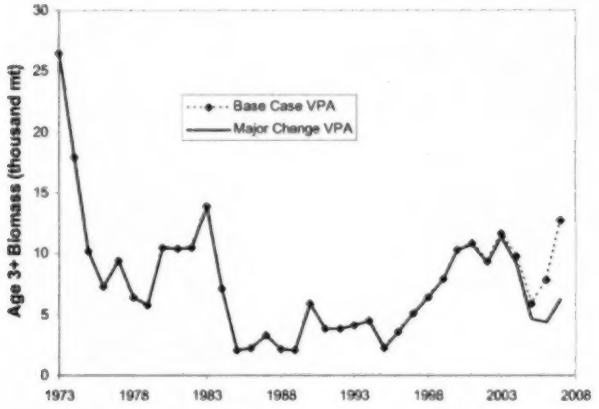


Figure 3. Ages 3+ biomasses.

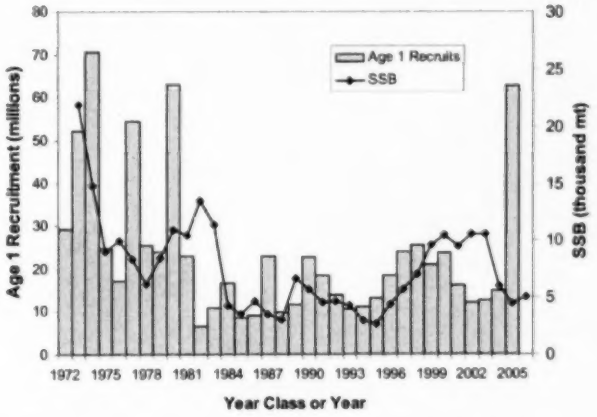


Figure 4. Recruitment and spawning stock biomass.